

Flood Risk Assessment and Drainage Strategy

Prepared by: Georgia Hirst

For: Store Property Investments Ltd

Site: Burger King Worthington Road Service

Date: 19/05/2026

Document Ref: 322080

Issue-01

www.arthian.com

Quality Assurance

Issue Record

Revision	Description	Date	Author	Reviewer	Approver
01	First Issue	19/05/2026	GH	JE	HP

Staff Detail

Initials	Name	Position	Signature
GH	Georgia Hirst	Flood Risk and Drainage Consultant	
JE	Jamie Eden	Senior Flood Risk and Drainage Consultant	
HP	Hayder Pars	Principal Flood Risk Engineer	



Contents

Reference of Terms	5
1. Introduction	8
1.1 Acknowledgement	8
1.2 Project Understanding	8
1.3 Sources of Information.....	9
1.4 Project Limitations.....	9
2. Site Details	10
2.2 Site Location.....	11
2.3 Existing Site Conditions.....	11
2.4 Topography.....	11
2.5 Hydrology	12
2.6 Geology	12
2.7 Hydrogeology.....	14
2.8 Local Drainage.....	14
2.9 Development Proposals	14
3. Relevant Planning Policy and Guidance	15
3.1 Introduction.....	15
3.2 Assessment of Flood Risk	15
3.3 Defra National Standards for Sustainable Drainage Systems (SuDS)	15
3.4 National Planning Policy Framework.....	16
3.5 Local Policy	17
3.6 Climate Change.....	18
3.7 Consultation.....	19
4. Assessment of Flood Risk	20
4.1 Tidal/Fluvial Flood Risk	20
Surface Water Flood Risk	22
4.2	22
4.3 Groundwater Flood Risk.....	23
4.4 Sewer Flooding	24
4.5 Reservoir and Canal Flooding.....	24
4.6 Residual Flood Risks	25
4.7 Summary of Flood Risk.....	25
5. Drainage Strategy.....	26
5.1 Introduction.....	26
5.2 Drainage Hierarchy	26
5.3 Surface Water Discharge.....	27
5.4 Sustainable Drainage Systems	28
5.5 Storage.....	33



5.6	Preferred Drainage Scheme.....	34
5.7	Event Exceedance.....	34
5.8	Surface Water Treatment	34
5.9	Maintenance	35
5.10	Foul Water Discharge	35
6.	Conclusions and Recommendations	36
6.1	Conclusions	36
6.2	Recommendations	36

Tables

Table 1: Flood Risk Vulnerability Classification (from Table 2 of the online Planning Practice Guidance	16
Table 2: Summary of Risk	25
Table 3: Greenfield Runoff Rates	28
Table 4: SuDS Options for Proposed Development.....	29
Table 5: Flow Controls - HydroBrake.....	33
Table 6: Attenuation Features - Basin	33
Table 8: Pollution Hazard Indices	35
Table 9: SuDS Mitigation Indices.....	35

Figures

Figure 1: Site Location.....	10
Figure 2: LiDAR Plan.....	11
Figure 3: Superficial Deposits.....	12
Figure 4: Bedrock Deposits	13
Figure 5: EA's Flood Map for Planning	20
Figure 6: Flood Zones and 3m AOD Contour.....	21
Figure 7: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)	23

Appendices

Appendix A- Limitations	39
Appendix B – Proposed Development	41
Appendix C – Drainage Calculations.....	42
Appendix D – Drainage Layout	43
Appendix E – Maintenance Schedules.....	44



Reference of Terms

Annual Exceedance Probability (AEP)

The AEP is the chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually and is usually expressed as a percentage.

Aquifers

- Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.
- Secondary B Aquifers are 'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.
- Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.
- Unproductive Strata are 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

Canal Failure

Canal failure can occur due to high-intensity rainfall or structural failure and can be dangerous due to the rapid release of large volumes of water. It is typically limited to raised canal reaches and can result in a rapid peak in flow followed by a gradual reduction.

Climate Change (CC)

A change in global or regional climate patterns. For flood risk, CC are assessed in terms of allowances which are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height. CC scenario data exists across different epochs (time periods) to determine the needs for climate resilience measures. CC data is requested as part of an EAPD request. If a separate ESG Flood Risk and CC Assessment is needed, additional CC data will be required.

Environment Agency (EA) and EA Product Data (EAPD)

The EA is the lead organisation for providing flood and coastal risk management and warnings of flooding from Main Rivers and on the coast. For sites within or in close elevational proximity to Flood Zone 2 or Flood Zone 3, EAPD is ordered to obtain more detailed flood risk data such as flood depths, breach and overtopping mapping and fluvial/tidal risks associated with CC.

Fluvial Flooding

Fluvial flooding typically occurs when a river's capacity is exceeded, and the excess water overtops the riverbanks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a backup of water which can overtop the banks. Typical flooding issues occur when the natural floodplain has been urbanised and the river has been confined. EA mapping defines three zones of different flood risk, the third of which is subdivided into two categories:



- Zone 1 “Low probability of flooding” – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- Zone 2 “Medium probability of flooding” – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year;
- Zone 3a “High probability of flooding” – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year; and
- Zone 3b “Functional floodplain” – A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high-water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Source Protection Zones

Source Protection Zones (SPZs) are areas of land through which water infiltrates into a groundwater borehole, well or spring that is used for public drinking water supply. These zones show the risk of contamination from potential pollution. SPZ's have been created as public facing boundaries where discrete groundwater bodies within SPZ's have been dissolved on zone number where common boundaries and overlaps have been removed. SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

- Zone 1 (Inner Protection Zone) is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius.
- Zone 2: (Outer Protection Zone) - This zone is defined by the 400-day travel time from a point below the water table. Additionally, this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction.
- Zone 3: (Total catchment) - This zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source. A further Zone 4, or ‘Zone of Special Interest’ was previously defined for some groundwater sources.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs because of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The



ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale-force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity, causing deep and widespread flooding. The likelihood of this occurring is low as large reservoirs are managed in accordance with the Reservoirs Act 1975. The EA's online reservoir inundation map illustrates the maximum flood extents that could occur in the event of a reservoir.



1. Introduction

1.1 Acknowledgement

- 1.1.1 This report has been prepared for the sole and exclusive use of Store Property Investments Ltd in accordance with the scope of work presented via letter agreement (ref: 322080/JE/040226/1.0) by Arthian, dated 04/02/2026. This report is based on information and data collected by Arthian. Should any of the information be incorrect, incomplete, or subject to change, Arthian may wish to revise the report accordingly.
- 1.1.2 Arthian have been instructed to provide a Flood Risk Assessment (FRA) and Drainage Strategy (DS) on Land at Worthington Road Services, A259, Rustington Bypass, Littlehampton, BN17 6LE (the site).

1.2 Project Understanding

- 1.2.1 The site is predominantly located within Flood Zone 1 (0.1% probability of flooding in any given year) on the Environment Agency (EA) Flood Map for Planning, however, the site is encroached by Flood Zone 2 (between a 0.1% and 1% probability of flooding in any given year) within the northeast corner of the site. There is a small area of the site at Low risk of surface water flooding (between 0.1% and 1% annual probability), but the majority is at Very Low risk (<0.1% annual probability). Therefore, a Flood Risk Assessment is required to support the application.
- 1.2.2 The aim of this report is to assess the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk (if required). This report has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) revised in February 2025, and the National Planning Practice Guidance (NPPG) Flood Risk and Coastal Change.
- 1.2.3 As proposals will increase hardstanding area at the site, a Drainage Strategy is required (DS) with appropriate consideration for Sustainable Drainage Systems (SuDS) in line with National standards for sustainable drainage systems (June 2025) and CIRIA SuDS (C753). A DS will be required to ensure that surface water flood risk is not exacerbated off-site as a result of the proposed development.
- 1.2.4 This report takes into account the following national and local policies:
- National Planning Policy Framework (NPPF) (2025)¹;
 - National Planning Practice Guidance (NPPG) (2022)²;
 - CIRIA Guidance: The SuDS Manual (C753) (2017)³;

¹ <https://assets.publishing.service.gov.uk/media/675abd214cbda57cacd3476e/NPPF-December-2024.pdf>

² <http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/>

³ https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx



- Defra National Standards for Sustainable Drainage Systems (SuDS) (2025);
- West Sussex and Arun County Council Local Development and Planning Policies.

1.3 Sources of Information

1.3.1 The following sources of information have been reviewed and assessed for the purpose of this FRA:

- EA online flood maps⁴;
- British Geological Society (BGS) Interactive Map⁵;
- MAGIC Interactive Map⁶;
- West Sussex Council Preliminary Flood Risk Assessment (2011 PFRA)⁷;
- Arun District Council Strategic Flood Risk Assessment (2016 SFRA)⁸;
- Arun District Council Surface Water Management Plan (2016 SWMP)⁹; and
- West Sussex County Council Local Flood Risk Management Strategy (2025 LFRMS)¹⁰;

1.4 Project Limitations

1.4.1 The wider Arthian limitations are contained within Appendix A.

⁴ <https://flood-map-for-planning.service.gov.uk/>

⁵ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁶ <http://www.magic.gov.uk/>

⁷ https://www.westsussex.gov.uk/media/1626/west_sussex_pfra.pdf

⁸ <https://www.arun.gov.uk/download.cfm?doc=docm93jjm4n9414.pdf&ver=9270>

⁹ <https://www.arun.gov.uk/download.cfm?doc=docm93jjm4n14209.pdf&ver=14458>

¹⁰ https://www.westsussex.gov.uk/media/zxfdrex1/westsussex_lfrms.pdf



2. Site Details

2.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment.

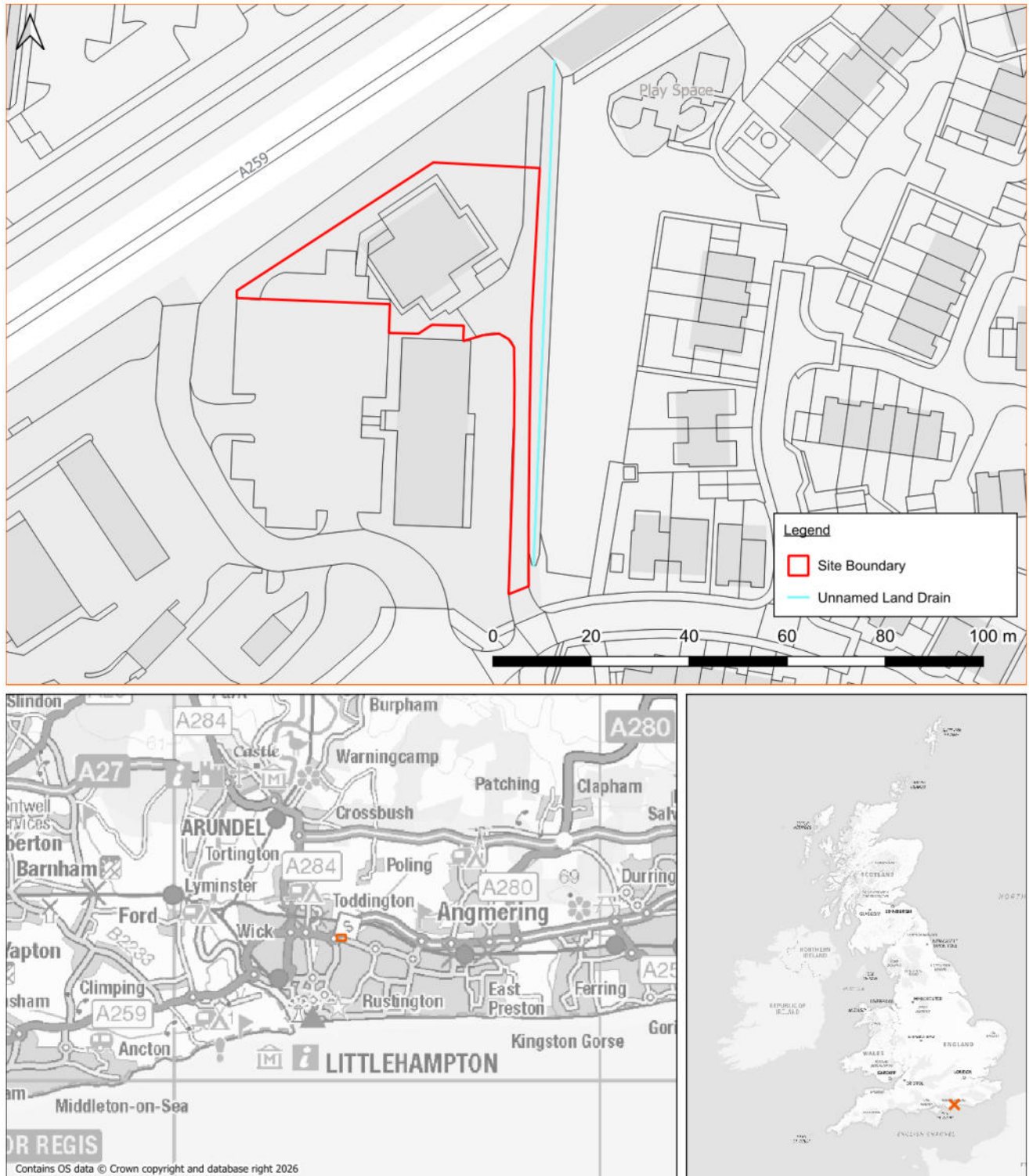


Figure 1: Site Location



2.2 Site Location

2.2.1 The site is located to the east of Wick, a suburb of Littlehampton in West Sussex, England. The closest train station is Littlehampton approximately 1.7km southwest of the site. In addition, the A259 is located immediately north of the site. The National Grid Reference for the site is 503910, 103390.

2.3 Existing Site Conditions

2.3.1 Online mapping (including Google Maps / Google Streetview imagery, accessed 27/04/2026) indicates that the site is occupied by Burger King and Subway, comprising a single storey building with an associated car park and access road. The site forms part of the Worthing Road Services, which includes a range of uses such as a Shell petrol station, a Travelodge hotel, Costa Coffee, and shared parking facilities.

2.3.2 The surrounding area is mixed-use, with light industrial and commercial units to the north and west, established residential neighbourhoods to the east and southeast, and a cemetery to the south. The site is also surrounded by roads with the A259 to the north, Norway Lane to the east, an unnamed road to the west and Worthing Road to the south. Access and egress is provided from Norway Lane to the east, which leads to Worthing Road, or the unnamed road to the west that leads to the A259 or Worthing Road.

2.4 Topography

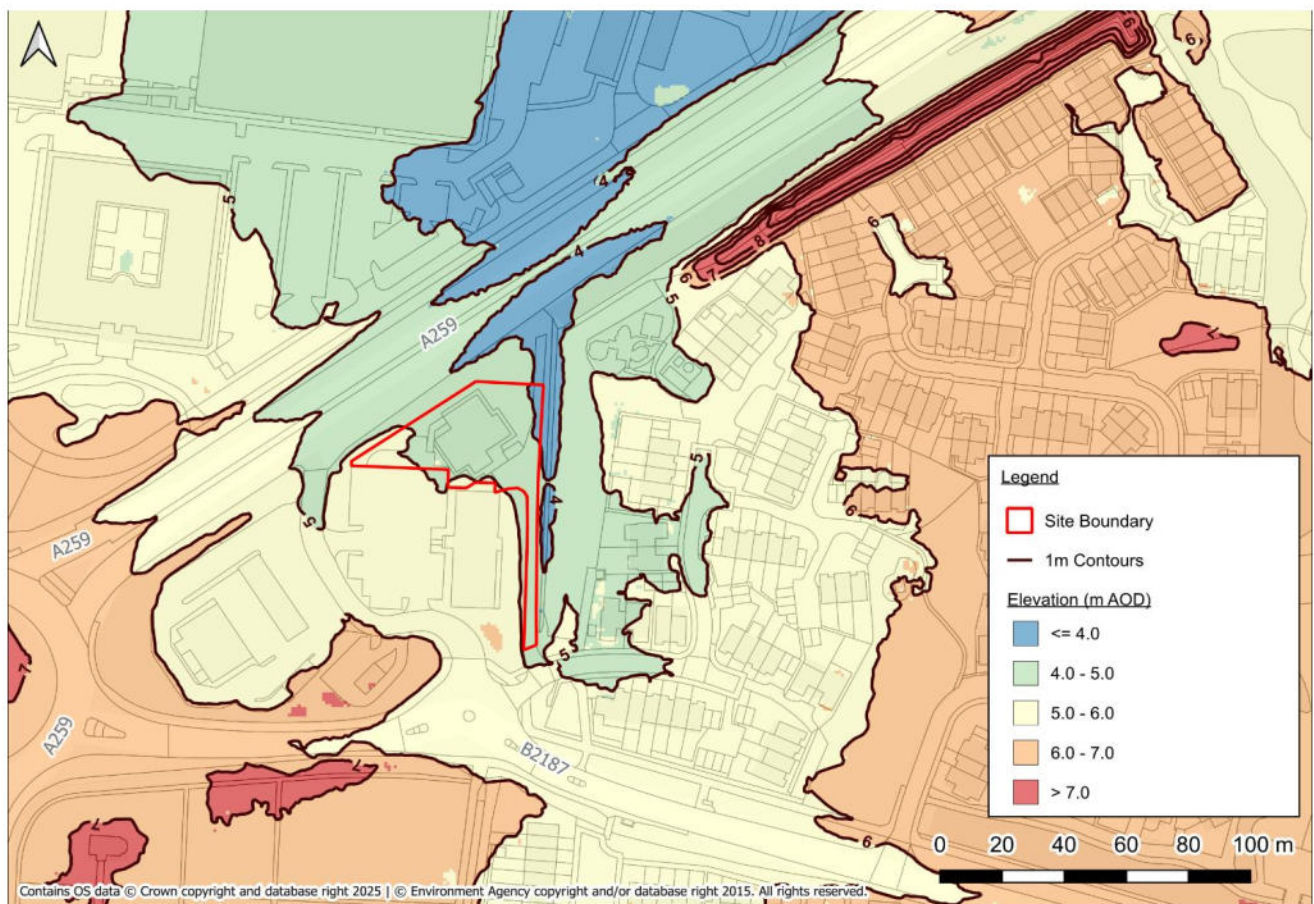


Figure 2: LiDAR Plan



2.4.1 Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR ground elevation data shows that the site is relatively flat at approximately 4m AOD (Figure 2), with the exception of the western and northeastern corner, with levels rising and falling to 5m AOD and 3m AOD, respectively.

2.5 Hydrology

2.5.1 The nearest watercourse is an unnamed land drain, which is an Ordinary Watercourse, running parallel to Norway Lane adjacent to the east of the site. The unnamed land drain flows to the north and joins Black Ditch Lake approximately 125m north of the site. The closest Main River is Black Ditch, located approximately 880m northeast of the site, which flows to the northwest. The River Arun, which is also a Main River, is located approximately 2km southwest of the site which flows to the south before joining the English Channel.

2.5.2 Main Rivers fall under the responsibility of the EA. Ordinary Watercourses are the responsibility of the riparian owner, with regulatory oversight provided by the Lead Local Flood Authority (LLFA). Consultation with the LLFA can help clarify whether any neighbouring land drains are considered Ordinary Watercourses and therefore fall under riparian ownership and LLFA regulatory oversight.

2.6 Geology

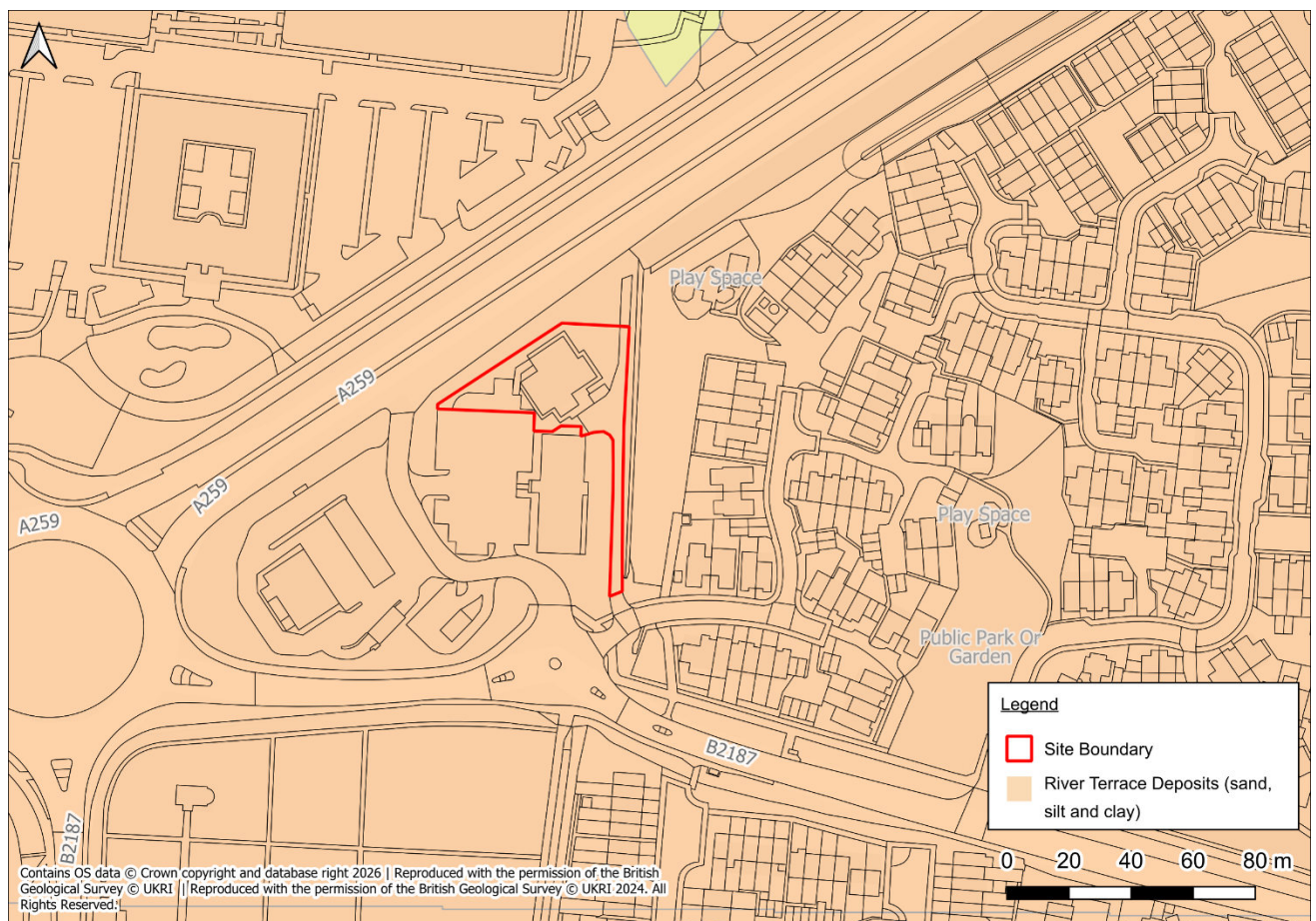


Figure 3: Superficial Deposits



2.6.1 Reference to the British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the site is underlain by superficial deposits of River Terrace Deposits generally comprising sand, silt, and clay (Figure 3). The superficial deposits are identified as being underlain by New Pit Chalk Formation consisting of Chalk (Figure 4).

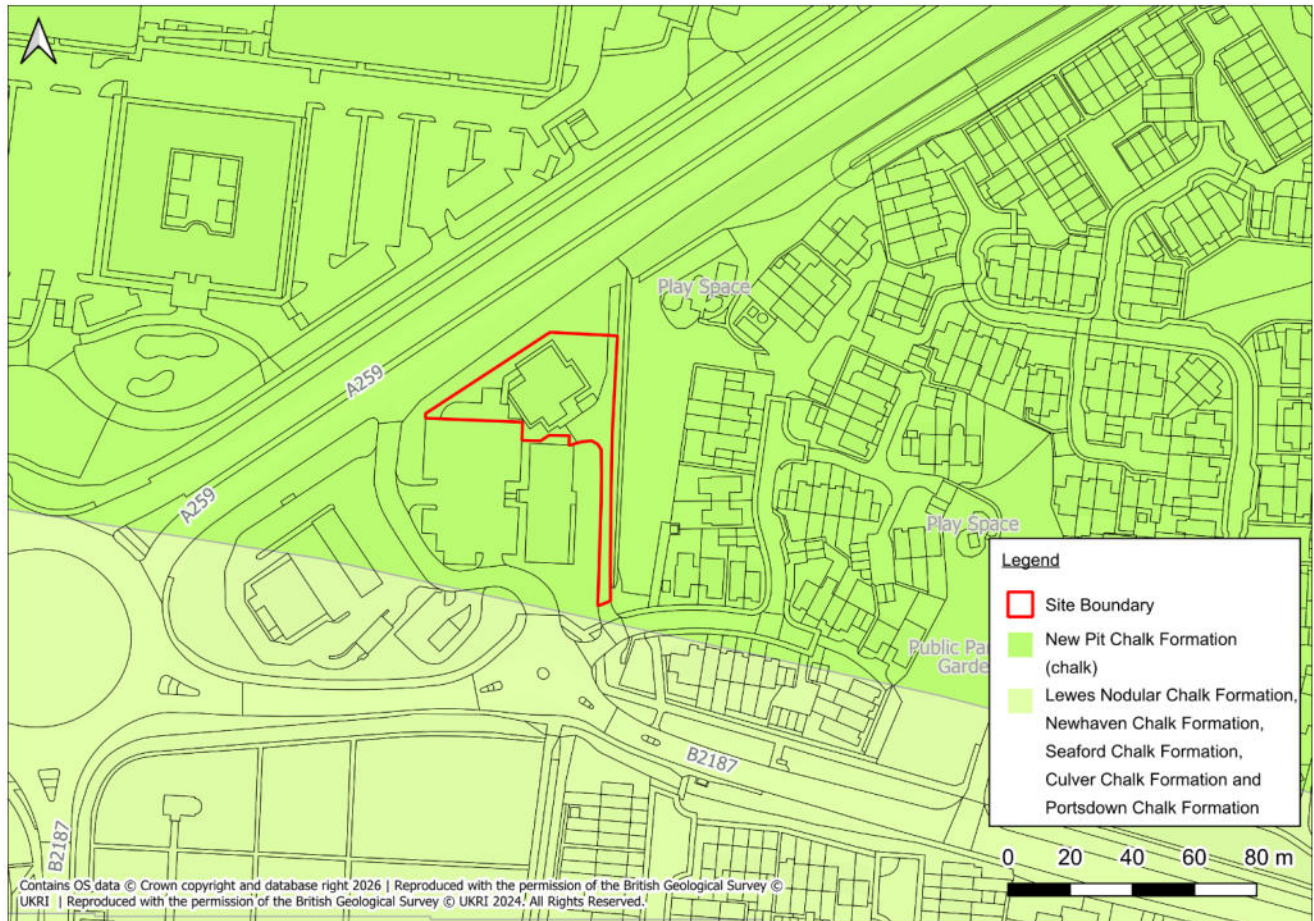


Figure 4: Bedrock Deposits

2.6.2 The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

2.6.3 The closest historical BGS borehole record (BGS Ref: TQ00SW134) is located 30m north of the site (NGR 503887, 103405). The borehole record indicates that the following geology was encountered:

- Topsoil to 0.3m below ground level (bgl);
- Clay from 0.3m to 1.3m bgl; and
- Chalk from 1.3m to 5.0m bgl.

2.6.4 No groundwater was encountered in the closest borehole; however, two boreholes (Ref: TQ00SW135 and TQ00SW136) located approximately 65m northeast of the site, recorded water rising within the boreholes after 20 minutes. Borehole TQ00SW135 rose to 1.3m and Borehole TQ00SW136 rose to 3.5m.

2.7 Hydrogeology

- 2.7.1 According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping [accessed 28/04/2026], the River Terrace Deposits is classified as a Secondary A Aquifer.
- 2.7.2 The underlying New Pit Chalk Formation is described as a Principal Aquifer.
- 2.7.3 The EA's 'Source Protection Zones' data, obtained from MAGIC Map's online mapping [accessed 28/04/2026] indicates that the site is not located within a Groundwater Source Protection Zone.

2.8 Local Drainage

- 2.8.1 Public sewer records have not been obtained as the proposed development is proposed to discharge to the nearest watercourse.

2.9 Development Proposals

- 2.9.1 The proposed development is for the addition of a drive-thru lane associated with the Burger King at the site. A proposed development plan is included in Appendix B.
- 2.9.2 The proposed development will result in an increase in hardstanding areas in the form of a drive-thru. The new hardstanding will comprise approximately 264m² or 17% of the total site area. In addition to this new area, the site also contains existing hardstanding in the form of a Burger King with associated car parking and access, which will be retained as part of the development. The remaining permeable, soft landscaped areas will occupy 1,294m² or 83% of the total site area. The hardstanding has been calculated using the Client Drawing (3981-SRA-XX-XX-D-A-SK-101-P07-Proposed Sketch Option 1), AutoCAD and QGIS.



3. Relevant Planning Policy and Guidance

3.1 Introduction

- 3.1.1 The aim of this section of the report is to discuss the main aspects of the local and national planning policies that are relevant to any proposed development on the site and relevant guidance and legislation.

3.2 Assessment of Flood Risk

- 3.2.1 The flood risk from fluvial (Main Rivers) and coastal flooding is assessed through the use of the EA Flood Maps (flood risk from rivers or the sea). This map defines three zones of different flood risk, the third of which is subdivided into two categories:

- Zone 1 “Low probability of flooding” – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- Zone 2 “Medium probability of flooding” – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year;
- Zone 3a “High probability of flooding” – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year; and
- Zone 3b “Functional floodplain” – A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

3.3 Defra National Standards for Sustainable Drainage Systems (SuDS)

- 3.3.1 The National Standards for Sustainable Drainage Systems (SuDS), published by Defra in July 2025, set out the minimum requirements for the design, construction, operation and maintenance of surface water drainage in new development. The standards aim to ensure that drainage systems mimic natural processes, manage water close to source, and do not increase flood risk on or off-site. The guidance places emphasis on capturing and treating frequent rainfall events, protecting water quality, and delivering wider benefits such as amenity, biodiversity and climate resilience.

- 3.3.2 Key requirements of the standards include:

- Managing runoff according to a clear hierarchy: reuse, infiltration, discharge to surface water, discharge to surface water sewer, and finally combined sewer.
- Ensuring interception of the first 5mm of rainfall in the majority of events to reduce pollution and replicate natural drainage.
- Controlling peak flow rates and runoff volumes so that flood risk is not increased, with allowances for climate change.
- Designing for extreme rainfall events with safe exceedance flow paths and on-site flood management.
- Protecting water quality through appropriate treatment measures and a SuDS management train.



- Maximising wider benefits for amenity, biodiversity and landscape integration.
- Supporting long-term effectiveness with robust arrangements for management, inspection and maintenance.

3.4 National Planning Policy Framework

3.4.1 Flood risk in England is normally considered through the planning process in the NPPF (2025), produced by Ministry of Housing, Communities & Local Government.

3.4.2 The principal aim of the NPPF assessment of flood risk is that:

- Greater than one hectare in size;
- All proposals for new development (including minor development and change of use) in Flood Zones 2 and 3;
- Or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA);
- Land identified in a Strategic Flood Risk Assessment (SFRA) as being at increased flood risk in the future; and
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

3.4.3 A key part of the NPPF is that a proposed development must first pass a “Sequential Test” to demonstrate that the overall development proposal is appropriate in terms of flood risk. It ensures that a sequential approach is followed to guide new development to areas with the lowest probability of flooding.

Exception Test

3.4.4 The Exception Test determines whether the benefits of the proposed development will outweigh the potential flood risk.

Vulnerability Classification

Table 1: Flood Risk Vulnerability Classification (from Table 2 of the online Planning Practice Guidance)

3.4.5 In accordance with Annex 3 of the NPPG: Flood Risk and Coastal Change, commercial developments are considered to be ‘less vulnerable’.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water-Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	X	Exception Test Required	✓	✓



Zone 3b	Exception Test Required	X	X	X	✓
---------	-------------------------	---	---	---	---

✓ development is permitted

X development is not permitted

3.4.6 Table 2 of the NPPG (reproduced above as Table 1), states that ‘less vulnerable’ development is considered appropriate within Flood Zone 1, 2 and 3a. The development therefore passes the flood risk Sequential Test and the Exception Test does not need to be applied.

3.5 Local Policy

3.5.1 The Arun Local Plan 2011-2031 (adopted in July 2018) contains the following policy in relation to flood risk and drainage:

“Policy W DM2 – Flood Risk

Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied:

- a. The sequential test in accordance with the National Planning Policy Guidance has been met.*
- b. A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.*
- c. The sustainability benefits to the wider community are clearly identified.*
- d. The scheme identifies adaptation and mitigation measures.*
- e. Appropriate flood warning and evacuation plans are in place; and*
- f. New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.*

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG. In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment. All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies.

Policy W DM3 – Sustainable Urban Drainage Systems

To increase the levels of water capture and storage and improve water quality, all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.

Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:



- *Green roofs*
- *Permeable driveways and parking*
- *Soakaways*
- *Water harvesting and storage features including water butts.*

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:

- *Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- *Effectively manage water (including its quality)*
- *Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- *Provide amenity for local residents (ensuring a safe environment)*
- *Retain the existing drainage network of the site and the wider area,*
- *Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.*

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- *Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.*
- *Undertake up to six months groundwater monitoring within the winter period.*
- *Undertake winter percolation testing in accordance with BRE365.*
- *The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.*
- *The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas.”*

3.6 Climate Change

- 3.6.1 The EA ‘Flood Risk Assessments: Climate Change Allowances’ Guidance states that Less Vulnerable developments should utilise the Central Allowance. The EA’s Online Peak River Flow Map¹¹ indicates that within the Arun and Western Streams Management Catchment, the Central Allowance equates to 13%

¹¹ Environment Agency Climate Change Guidance: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

for the 2050s epoch and 25% for the 2080s epoch.

3.6.2 The EA's Online Peak Rainfall Allowance Map indicates that within the Arun and Western Streams Management Catchment, the central allowance equates to 20% for the 2050s epoch and 25% for the 2080s epoch.

3.7 Consultation

3.7.1 Product data was requested from the EA in April 2025, a response is awaited.



4. Assessment of Flood Risk

4.1 Tidal/Fluvial Flood Risk

- 4.1.1 The site is primarily located within Flood Zone 1, meaning there is a 0.1% annual probability of flooding from rivers and the sea. A small area of Flood Zone 2 (between 0.1% and 1% annual probability) extends within the northeastern corner associated with the unnamed land drain adjacent to the eastern boundary.
- 4.1.2 The unnamed land drain outfalls, that bounds the sites eastern boundary, outfalls into Black Ditch approximately 880m northeast of the site, which outfalls into the River Arun approximately 3km northwest of the site. Black Ditch and the River Arun are tidally influenced in the vicinity of the site, and potential flooding will be influenced by both tidal and fluvial mechanisms.
- 4.1.3 Both the Black Ditch and the River Arun have flood defences located along their banks in the vicinity of the site. Flooding could therefore also occur from overtopping of defences during an extreme events or from a breach of the flood defences.

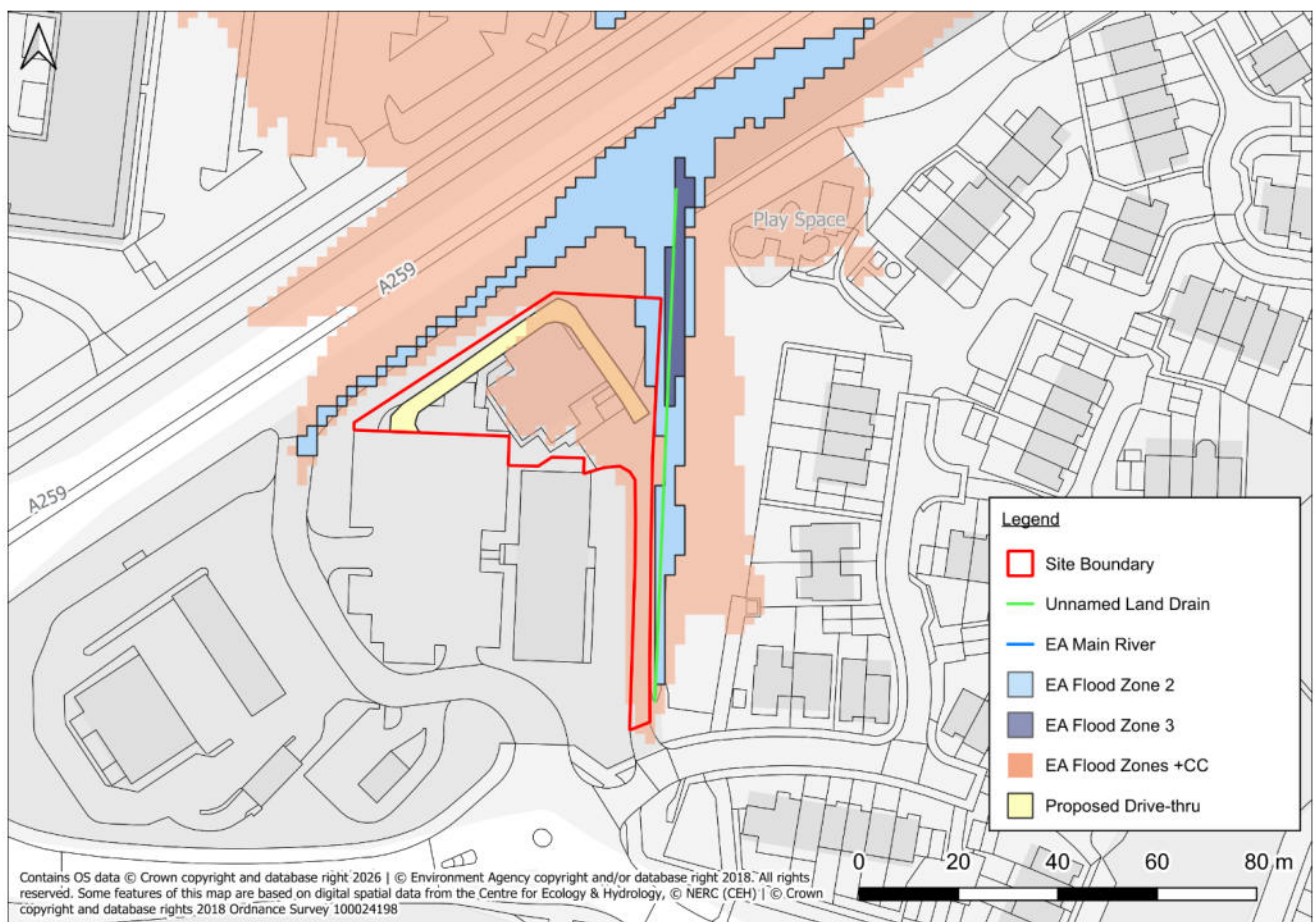


Figure 5: EA's Flood Map for Planning

- 4.1.4 As shown in Figure 5, the EA Flood Zones plus climate change layer (2070 to 2125) indicates that the flood extents will likely increase across the majority of the site with the exception of the far west of the site.

- 4.1.5 A comparison of site levels and the EA's flood extents shows predicted flooding to be confined to lower lying land along the unnamed land drain's route, which has elevations in the vicinity of 3m AOD, compared to the majority of the site area that has levels between 4m AOD to 5m AOD. The EA's flood zones are therefore highlighting the topographic depression of the unnamed land drain as opposed to notable widespread flooding.
- 4.1.6 Furthermore, noting the unnamed land drain is only an open channel for a short length, incoming flows from the south will be limited. The potential for any out of channel flooding originating upstream of the site during the present-day scenario is therefore unlikely, and any limited flow will be conveyed along the unnamed land drain and accumulate in the area of lower lying land as currently indicated before being conveyed to the north.
- 4.1.7 When accounting for potential future climate change, the EA Flood Zones plus climate change layer indicates that between 2070-2115, the flooding has the potential to exceed the land drain and lower lying lands capacity and flow onto the site.

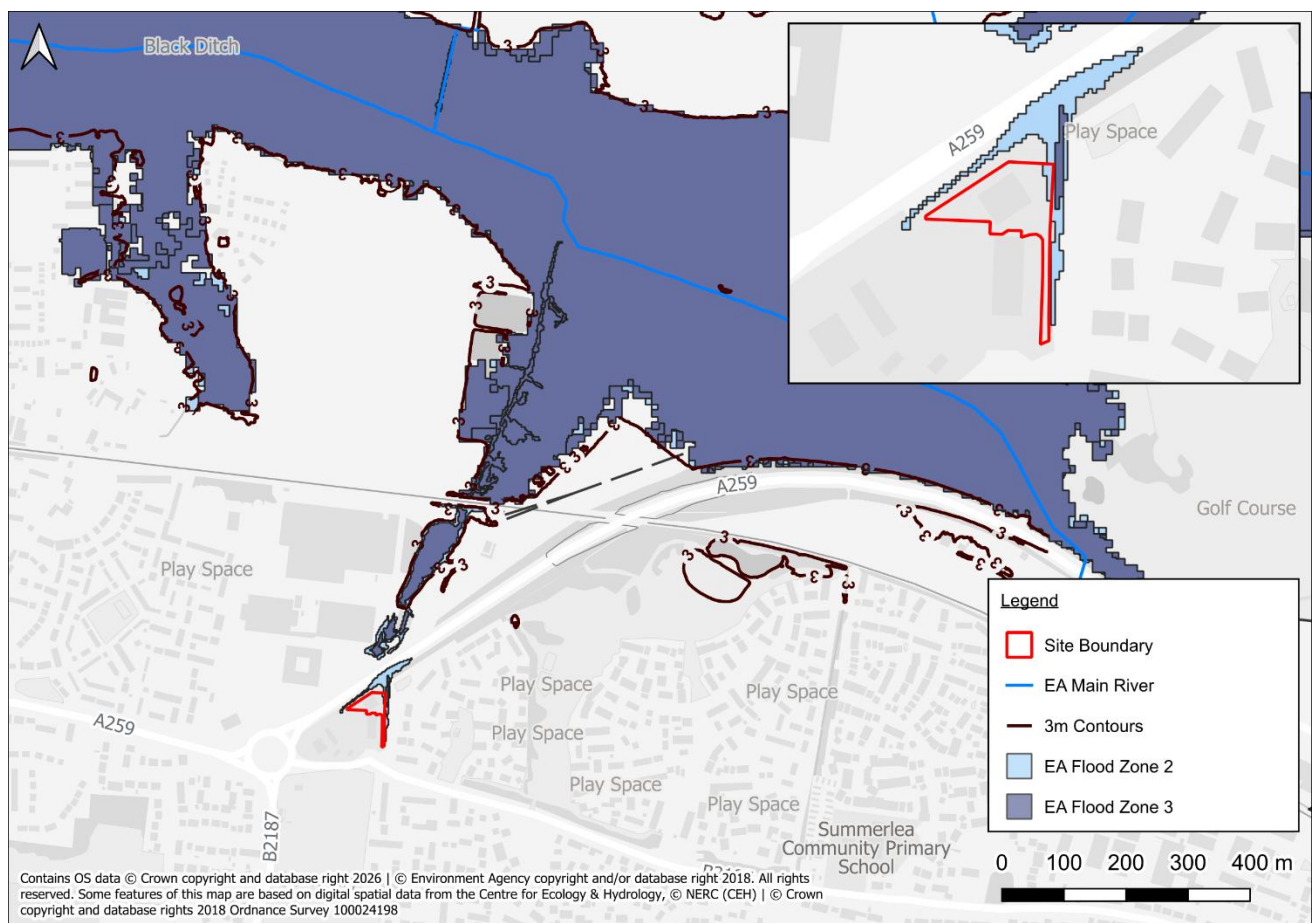


Figure 6: Flood Zones and 3m AOD Contour

- 4.1.8 While the River Arun and Black Ditch are tidally influenced to the north of the site, any impacts to combined fluvial and tidal flood risk are expected to be limited to the north of the railway line that's located approximately 350m north of the site (Figure 6). The hydraulic structure at this location will limit the tidal influences, with flooding to the site expected to be predominantly influenced by fluvial flows in the unnamed land drain. Figure 6 also shows that the flood extents remain confined to the 3m AOD



contour line.

- 4.1.9 The EA 'Recorded Flood Outlines Map' indicates that the site has not been previously flooded.
- 4.1.10 According to the EA's 'Spatial Flood Defences with Standardised Attributes' dataset, there are no formal flood defences along the Black Ditch. However, there is natural high ground along the banks of the Black Ditch. Additionally, the River Arun banks are surrounded by an embankment and a flood wall with a Standard of Protection (SoP) of up to 1 in 300 years and a condition of Good. The defence has a crest level ranging between 4.1 and 4.8m AOD.
- 4.1.11 The 2016 SFRA states that "*climate change is predicted to influence the rate of sea level rise, in addition to offshore wind speed and extreme wave height. However, sea level rise will influence the tidal levels which propagate upstream along the tidal rivers in the district, thereby impacting flood risk.*" The 2016 SFRA also indicates that a Flood Risk Management Scheme was conducted in May 2013 along the River Arun which protected the town of Littlehampton against a 1 in 300 year flood event, which corresponds with the above information.
- 4.1.12 It should be noted that the site is considered to be at residual risk from a breach event from tidal/fluviat flooding, however any impacts to the site are expected to be negligible. This is due to the presence of intervening infrastructure that will limit flows passing towards the site, such as the raised railway and a road to the north of the site, therefore an extent would not be expected to be greater than EA undefended flood zones.
- 4.1.13 Given that the Burger King restaurant is existing, the proposed development comprises only a small area of additional hardstanding to facilitate a drive-thru, and the present-day flood extents do not impact the drive-thru area, the site is considered to be at **Low** risk of tidal/fluviat flooding. However, if future development is proposed, it is recommended to attain receipt of EA Product Data which will likely provide climate change scenarios and flood depths for the site.

4.2 Surface Water Flood Risk

- 4.2.1 The EA 'Flood Risk from Surface Water' map (Figure 7) indicates that the site is primarily at Very Low risk of surface water flooding, meaning it has <0.1% annual probability. There is an area within the west and northeast corner of the site at Low risk (between 0.1% and 1% annual probability) of surface water flooding; however, this is considered residual risk associated with extremely unlikely scenario.
- 4.2.2 There is also Low to Medium (between 0.1% and 3.3% annual probability) surface water risk immediately adjacent to the east of the site. However, this corresponds with the topographic depression along the route of the unnamed land drain and is primarily representative of channel flows.
- 4.2.3 The EA's surface water plus climate change map indicates that the areas potentially at risk of surface water ponding on the site (west and northeast corner) remain the same. However, surface water flooding is also present during the Medium risk (between 1% and 3.3%) scenario.
- 4.2.4 EA flood depths during all assessed scenarios (including the surface water plus climate change) are anticipated to be below 300mm. In addition, predicted flow velocities within the areas at risk of surface water flooding are shown to exhibit low flow velocities of up to approximately 0.25m/s, which is



considered to be a Very Low hazard risk. Therefore, access/egress is considered passable by vehicles and people and is achievable.

- 4.2.5 While parts of the site are shown to be at risk, it is worth noting that the EA mapping does not accurately account for local drainage and is likely exaggerating the surface water flood risk. In addition, the adjoining areas are well developed and likely served by a modern drainage system, thereby reducing anticipated flood risk in the general area that might otherwise contribute to food risk within the unnamed land drain and exacerbate risk at the site.

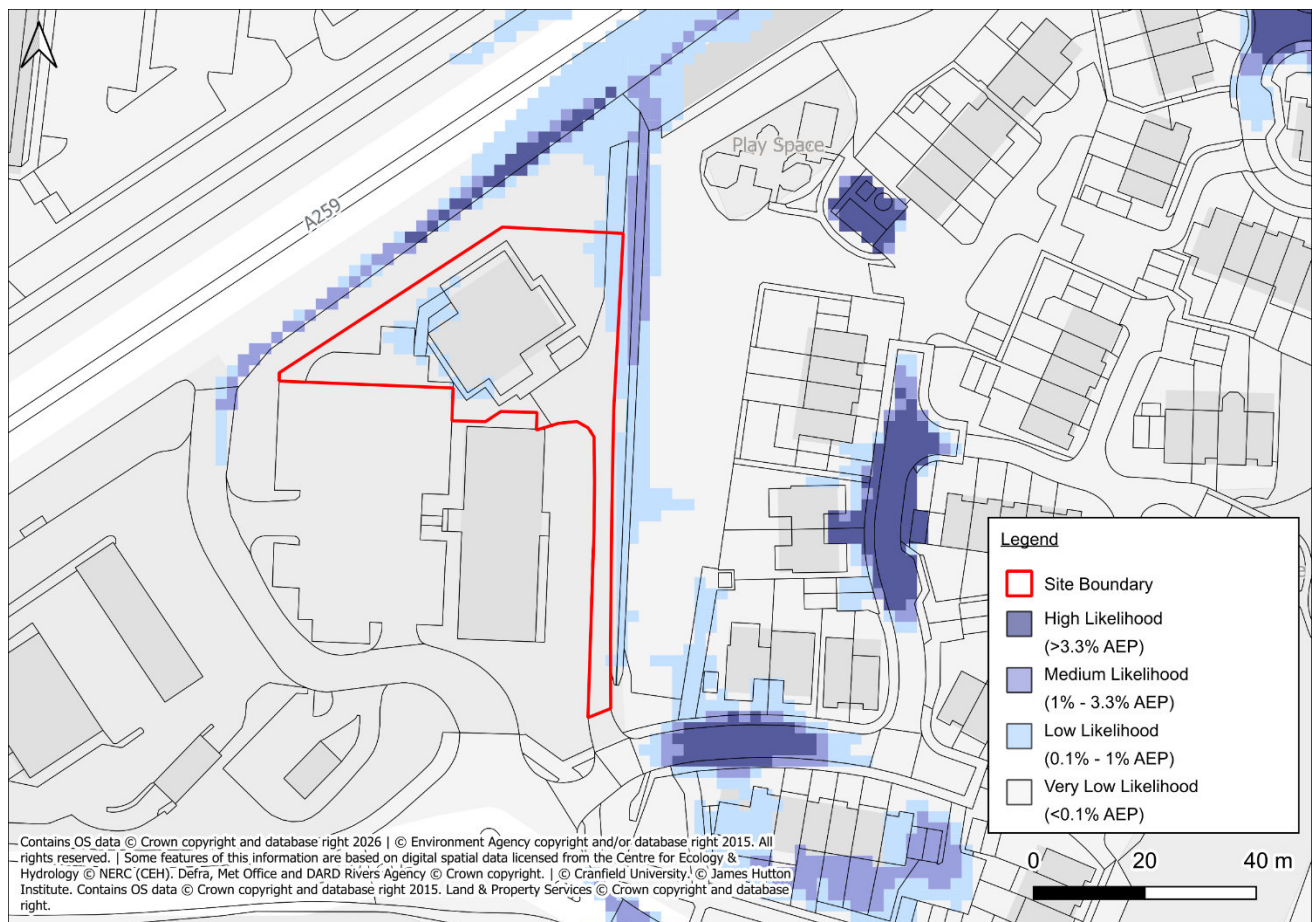


Figure 7: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)

- 4.2.6 There are no distinct flow routes in the area which would direct any potential surface water flooding towards the site.
- 4.2.7 There is no site specific information within third party reports relating to surface water flood risk.
- 4.2.8 Given the above, it can therefore be concluded that the site is at **Low** risk of surface water flooding. However, good practice measures include:
- Ensure on-site drainage is well maintained through a maintenance regime involving a regular monitoring and clearing of the drainage system.

4.3 Groundwater Flood Risk



- 4.3.1 The underlying geology comprises River Terrace Deposits over New Pit Chalk Formation. These units typically have moderate to high permeability characteristics, which generally facilitates groundwater emergence.
- 4.3.2 Available BGS borehole records indicate that the closest borehole (Ref: TQ00SW134) recorded no water strikes, however two boreholes (Ref: TQ00SW135 and TQ00SW136) in the near vicinity recorded groundwater emergence within the boreholes after 20 minutes.
- 4.3.3 As proposals are for a drive-thru, which comprises hardstanding, proposals will limit vertical migration of shallow groundwater for more vulnerable areas of the development. No basement or below ground areas, that might be at increased risk of ground water emergence, are included within the proposal.
- 4.3.4 In the event of any groundwater emergence, based on local topography, groundwater would be expected to be conveyed to the northeast (unnamed land drain) where it would be conveyed away from the site before building to a significant depth.
- 4.3.5 The 2016 SWMP states that the cause of groundwater flooding across the catchment is found to relate to high groundwater levels and saturation of the underlying chalk geology across the catchment reaching into the superficial deposits. However, there is no site specific information within third party reports regarding groundwater flooding at the site.
- 4.3.6 Given the nature of the proposed development and that it will limit vertical migration for shallow groundwater for more vulnerable areas of the development, the risk of groundwater flooding is considered to be **Low**.

4.4 Sewer Flooding

- 4.4.1 Sewer flood risk is typically hard to predict as it depends on a range of factors including sewer capacity, condition, and the frequency of extreme rainfall events.
- 4.4.2 Any potential surcharging within Norway Lane will likely be confined to the road before discharging to the adjoining unnamed drain and flowing to the north, following the local topography. Any sewer flooding would therefore be expected to be conveyed away from the site before building to significant depth.
- 4.4.3 The 2016 SFRA states that the DG5 register indicates a total of 315 recorded sewer flooding incidents in the Arun District and provides the amount of incidents per postcode area. The postcode area BN17 6 (beginning of the site's postcode) has recorded three incidents, however the exact location of these incidents are unknown. Therefore, there is no site specific information within third party reports regarding sewer flooding.
- 4.4.4 It can therefore be concluded that the risk of sewer flooding is **Low**.

4.5 Reservoir and Canal Flooding

- 4.5.1 There are no canals within the vicinity of the site and therefore there is negligible associated flood risk.
- 4.5.2 The EA 'Flood Risk from Reservoirs' map shows that the site is not at risk of flooding from reservoirs.



4.5.3 It can therefore be concluded that there is **Negligible** risk of flooding from artificial sources.

4.6 Residual Flood Risks

4.6.1 A residual risk is an exceedance event, such as the greater than 1 in 1000 year (<0.1% AEP) flood event that would overtop the unnamed land drain **Error! Reference source not found.** and potentially impact the site. As the probability of a 1 in 1000 year flood event occurring is <0.1% in any given year, the probability is low and, therefore, no further mitigation beyond what is proposed is required.

4.6.2 In the event of the defences failing or an exceedance event occurring, the residual risk to people working within the site can be managed through the implementation of an appropriate site management plan, which recognises the residual risks and details what action is to be taken by staff in the event of a flood to put occupants in a place of safety.

4.7 Summary of Flood Risk

4.7.1 It can be concluded that the site is at Negligible to Low risk of flooding from all sources. Therefore, no site-specific mitigation measures are considered necessary. However, good practice measures include:

- Ensure on-site drainage is well maintained through a maintenance regime involving a regular monitoring and clearing of the drainage system.

Source of Flooding		Summary of Risk
Tidal Flood Risk		Negligible
Fluvial Flood Risk		Low
Surface Water Flood Risk		Low
Groundwater Flood Risk		Low
Artificial Sources of Flood Risk	Sewer Flooding	Low
	Reservoir and Canal Flooding	Negligible



5. Drainage Strategy

5.1 Introduction

- 5.1.1 The site is currently occupied by a Burger King and Subway, comprising a single storey building with associated car park, access road, and landscaped areas.
- 5.1.2 The proposed development is for the addition of a drive-thru lane, which will introduce approximately 264m² of hardstanding area.
- 5.1.3 The increase in hardstanding area will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled.
- 5.1.4 The Arun Council surface water drainage planning guidance states that to ensure developments are adequately drained, it is expected surface water discharge will be designed in accordance with The CIRIA C753 SuDS Manual and National Standards. Controlled discharge from the site via the use of SuDS is therefore required.

5.2 Drainage Hierarchy

- 5.2.1 The proposed surface water drainage strategy has been prepared in accordance with the drainage hierarchy set out in the National Standards for Sustainable Drainage Systems (SuDS) and in line with Paragraph 080 of the National Planning Practice Guidance (NPPG): Flood Risk and Coastal Change. This approach is to utilise soakaway systems or infiltration as the preferred option, followed by discharging to an appropriate watercourse. If this is not feasible, the final option is to discharge to an existing public sewer.
- 5.2.2 The hierarchy establishes the following order of preference for runoff destinations:
- Priority 1: Collect surface water for reuse within the development (e.g. irrigation or non-potable supply).
 - Priority 2: Infiltrate runoff to the ground, where ground conditions and groundwater levels permit.
 - Priority 3: Discharge runoff to an above-ground surface water body such as a watercourse, pond or wetland.
 - Priority 4: Discharge runoff to a surface water sewer, highway drain or other drainage system.
 - Priority 5: Discharge runoff to a combined sewer.
- 5.2.3 Where higher levels of the hierarchy cannot be achieved, proportionate justification must be provided to demonstrate compliance with national policy while ensuring effective flood risk management and long-term sustainability.

Priority 1: Surface Water Collected for non-Potable Use

- 5.2.4 Rainwater harvesting has been considered for this development. As the proposed development



comprises no new building or road area to utilise rainwater harvesting, an alternative method of discharge is required.

Priority 2: Surface Water Infiltrated to Ground

- 5.2.5 Where surface water collected for non-potable use (Priority 1) cannot be the sole method of disposal, the next consideration is infiltration (soakaways and permeable surfaces).
- 5.2.6 As discussed previously, the site is underlain by superficial deposits of River Terrace Deposits, which is underlain by New Pit Chalk Formation. Soilsmap also describes the site as having “*freely draining slightly acid loamy soils – freely draining*”.
- 5.2.7 While soil conditions may be suitable for infiltration, as indicated previously, the Arun area is known to have high groundwater levels and boreholes within close proximity to the site have recorded rising groundwater. The site also comprises existing development and there is potential for made ground to be present within the underlying geology, which is not suitable for implementing soakaways
- 5.2.8 In line with the National Standards for SuDS, infiltration shall only be used where ground conditions are suitable, groundwater is protected, and land stability is not compromised. Discharge via infiltration may therefore not be feasible based on current ground conditions.
- 5.2.9 Therefore, in order to demonstrate a viable means of controlled surface water discharge from the site is available, the use of soakaways has been discounted at this stage.

Priority 3: Discharge to an Above Ground Surface Water Body

- 5.2.10 Where surface water collected for non-potable use (Priority 1) cannot be the sole method of disposal, and infiltration to ground (Priority 2) has been demonstrated to be unsuitable, discharge to a watercourse should be the next consideration.
- 5.2.11 The nearest watercourse is an unnamed land drain, located adjacent to the east of the site. Discharge to this watercourse at a controlled rate is therefore proposed. This outfall location and rate is subject to approval from the LLFA.

Priority 4: Discharged to a Surface Water Sewer, or Another Piped Surface Water Drainage System

- 5.2.12 As described above, a connection to the unnamed land drain is considered feasible; therefore, a connection to the public surface water sewer is not required.

Priority 5: Discharge to a Combined Sewer

- 5.2.13 As described above, a connection to the unnamed land drain is considered feasible; therefore, a connection to a combined sewer is not required.

5.3 Surface Water Discharge

- 5.3.1 In accordance with the 2025 National Standards for SuDS in England Guidance, runoff destinations have been assessed following the required hierarchy, demonstrated above.



- 5.3.2 As rainwater reuse is not suitable and infiltration is not considered feasible for the site, runoff is required to be attenuated on site and discharged at controlled rates to the watercourse in line with greenfield runoff principles.
- 5.3.3 As required by the 2025 National Standards SuDS DEFRA guidance, the allowable discharge rate will be limited to the 50% AEP (QBAR) greenfield runoff rate or 3l/s/ha, whichever is the greater. Greenfield runoff rates estimated using the FEH Statistical (2025) method are provided in Table 3 and detailed in Appendix C, while a site discharge rate based on the 3 l/s/ha allowance is equal to 0.1 l/s.
- 5.3.4 In order to achieve the negligible runoff rates, any flow control device would have to have a minimal orifice diameter that would be at significant risk of blockage and failure. As per the National standards, any flow control with an orifice diameter of less than 50mm is considered to be at increased risk of and require robust protection from blockage. Limiting discharge to the 50% AEP, which would require an orifice flow control with an approximate diameter of 10mm, is therefore not considered practicable.
- 5.3.5 Instead, acknowledging the limited scale and scope of the development proposals, and implementation of blockage protection may be limited, it is proposed to restrict discharge to 0.9 l/s. As detailed in Section 5.5, this rate can be achieved using a flow control with an orifice diameter of 51mm, thereby limiting rates as far as practicable while reducing the chance of blockage subject to implementation of appropriate management and maintenance measures.

Table 3: Greenfield Runoff Rates

Return Period (Years)	Runoff Rate (l/s)
1 in 2	0.1
1 in 10	0.1
1 in 30	0.2
1 in 100	0.3
1 in 1000	0.3

5.4 Sustainable Drainage Systems

- 5.4.1 The SuDS appraisal approach outlined in the SuDS Manual (C753) has been applied to determine the most suitable methods for achieving sustainable surface water attenuation and conveyance to support the proposed development. The SuDS options summarised in Table 4 below have been considered:



Table 4: SuDS Options for Proposed Development

SuDS Measure	Amenity Benefit	Biodiversity Benefit	Suitability for Proposed Development	Reasoning
Soakaways	Although soakaways are typically below ground, they can contribute to amenity by allowing the land above to be used for landscaping or recreation. When integrated with visible SuDS features or planting, they can enhance the visual quality of a site and support multifunctional, attractive spaces.	Soakaways support biodiversity indirectly by promoting groundwater recharge and maintaining natural hydrological conditions. When combined with vegetated SuDS components, they can enhance habitat connectivity and contribute to ecological networks across a site.	X	As described above, the use of soakaways is not considered to be feasible due to the potential high groundwater levels and the presence of made ground within the underlying geology.
Swales, Detention Basins and Ponds	Swales, detention basins and ponds contribute positively to site amenity by providing visually attractive, multifunctional spaces that enhance the quality and character of a development. These features can be integrated within the landscape as green corridors, linking open spaces and promoting interaction between people and water. When appropriately designed, they offer opportunities for recreation, education and visual interest, creating a more appealing and liveable environment.	Swales, detention basins and ponds deliver significant biodiversity value through the provision of varied and connected habitats. Swales function as linear green corridors, enabling wildlife movement and supporting diverse vegetation. Detention basins create temporary wetland conditions that benefit a range of species, while ponds provide permanent aquatic and marginal habitats supporting invertebrates, amphibians and birds. Collectively, these features enhance habitat diversity, strengthen ecological connectivity and contribute to	✓	Sufficient space is available on site to utilise a basin or oversized swale as an above ground attenuation feature. In order to facilitate gravity drainage, attenuation features should be located at the lower northeastern extent of the site. An open surface water attenuation feature such as a basin or a swale presents a safety risk. If chosen, the hazards and appropriate mitigation should be considered at the detailed design stage.

		the establishment of a resilient green-blue network across the site.		
Filter Drains/ Strips	Filter drains and filter strips can contribute to site amenity by creating attractive, vegetated edges that soften hard surfaces and integrate drainage within the landscape. When aligned along roads or paths, they form part of functional green corridors that enhance visual quality and support a sense of place.	These features provide ecological value through vegetated zones that support invertebrates and small fauna. When linked with other SuDS components, they strengthen habitat connectivity and contribute to the wider green-blue network promoted within the SuDS approach.	✓	Filter drains are trenches filled with stone/gravel that create temporary subsurface storage for the filtration, attenuation, and conveyance of surface water runoff. Ideally, filter drains receive lateral inflow from adjacent impermeable surfaces pretreated over a filter strip. Filter drains can help manage peak flows by naturally limiting rates of conveyance through the filter medium and by providing attenuation storage when the rate of flow at the outlet is controlled.
Bioretention Systems	Bioretention systems, including rain gardens and bioretention planters, provide attractive, vegetated features that enhance the streetscape and create visually appealing focal points within developments. They contribute to high-quality, multifunctional spaces by integrating drainage into the landscape and improving the relationship between people, water and planting.	These systems deliver biodiversity value through diverse planting and soil conditions that support pollinators, invertebrates and small fauna. They also play a key role in improving water quality by filtering and treating pollutants from surface runoff before infiltration or discharge. Collectively, they enhance ecological connectivity and contribute to the wider green-blue infrastructure.	X	Bioretention systems (including rain gardens and raised box planters) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. They also provide attractive landscape features and biodiversity. Bioretention systems can help reduce flow rates from a site by promoting infiltration / evapotranspiration and providing some attenuation storage. Bioretention systems can also provide very effective treatment functionality. Bioretention systems are a very flexible surface water management component that can be integrated into a wide variety of developments / densities using different shapes, materials, planting, and dimensions. Bioretention systems are considered not commensurate for the proposed development.

Rainwater Harvesting	Rainwater harvesting systems can contribute to site amenity by visibly demonstrating sustainable water management and promoting environmental awareness. When integrated within building or landscape design, they can enhance the character of a development by supporting water features, irrigation, or other non-potable uses that add functional and aesthetic value to spaces.	By reducing surface water runoff, rainwater harvesting systems help protect downstream SuDS features and receiving watercourses from pollution and erosion. Stored water can also be used to support planting and green infrastructure, indirectly benefiting biodiversity through improved vegetation health and habitat provision.	X	Given that the proposed development comprises no new buildings or roofs, rainwater harvesting cannot be utilised.
Green Roofs	Green roofs enhance the visual quality of buildings and contribute to the creation of more attractive and liveable urban environments. They can provide accessible or visual green spaces within dense developments, offering opportunities for recreation, relaxation, and improved wellbeing while demonstrating sustainable design in practice.	Green roofs support biodiversity by providing valuable habitats for invertebrates, birds, and pollinators, particularly where native or species-rich planting is used. They also improve water quality and reduce runoff rates by capturing, filtering, and slowly releasing rainfall, supporting the wider SuDS objectives of managing water quantity, quality, and ecology.	X	The proposed development is for the addition of a drive-thru lane, which does not include any roofs and therefore green roofs are not appropriate for this type of development.
Porous/ Permeable Surfacing (infiltration)	Porous and permeable surfaces can enhance the quality and functionality of developed areas by integrating drainage directly into hardstanding such as car parks, footpaths and access roads. They maintain a natural appearance, reduce surface water ponding, and contribute	Infiltration-based permeable surfaces promote natural groundwater recharge and improve water quality by filtering and retaining pollutants within the sub-base before infiltration. When combined with adjacent vegetated SuDS features, they can contribute to	X	Given that there is potential for high groundwater levels, any SuDS features will need to be lined to ensure storage capacity is available during wet periods and unlined permeable surfacing that promote infiltration and not considered feasible. Subject to being lined, storage could be provided within a permeable surfaces sub-

	to safer, more attractive public spaces while supporting the seamless integration of SuDS within the built environment.	habitat connectivity and support the wider green-blue network across a site.		grade material prior to controlled release to the receiving watercourse. The amount of storage offered by permeable paving is subject to sub-grade depth and site gradient.
Porous/ Permeable Surfacing (Lined)	Lined porous and permeable surfaces provide an attractive, functional drainage solution that manages runoff close to source while maintaining the appearance and usability of hardstanding areas such as car parks, courtyards and footpaths. They support high-quality, multi-functional urban design by integrating water management within the built environment without detracting from site amenity.	Although infiltration is prevented, lined permeable surfaces still contribute to SuDS objectives by providing effective pollutant removal through filtration and sedimentation within the surface and sub-base layers. By controlling and treating runoff before discharge to other SuDS components, they protect downstream water quality and can indirectly support biodiversity by maintaining cleaner flows to connected green-blue infrastructure.	✓	
Underground Attenuation Tanks / Geocellular Storage / Oversized Pipes	Underground attenuation tanks and geocellular storage systems provide essential runoff control while preserving the use and appearance of surface areas. By locating storage below ground, they enable land above to be used for landscaping, parking, or recreation, supporting efficient land use and maintaining overall site amenity.	These systems offer limited direct biodiversity value but can contribute indirectly by facilitating above-ground green spaces and protecting downstream SuDS features. When designed with pre-treatment measures, they assist in pollutant removal, improving water quality prior to discharge and supporting the performance of connected ecological SuDS components.	✗	While potentially appreciate for providing storage, underground attenuation storage will not be considered, as alternative SuDS features have been identified that can provide sufficient on-site attenuation while offering additional water quality, amenity, and biodiversity benefits.

5.5 Storage

Extreme Rainfall

- 5.5.1 In order to manage extreme rainfall events and achieve a discharge rate of 0.9l/s, attenuation storage will be required. Based on the review of viable SuDS features for the site, a basin is proposed to manage surface water runoff. The drainage layout drawing provided in Appendix D illustrates the proposed system.
- 5.5.2 Hydraulic calculations carried out in Causeway Flow demonstrate the proposed arrangement has sufficient capacity to sustainably manage runoff in up to the 1%+CC (25%) AEP event. Key details for the proposed attenuation features and flow control required to managed surface water runoff are summarised in Table 5 and Table 6 below. Hydraulic calculations are provided in Appendix C.

Table 5: Flow Controls - HydroBrake

Proposed Discharge Rate (l/s)	0.9
Design Head (m)	0.5
Orifice Diameter (mm)	51.0

Table 6: Attenuation Features - Basin

Contributing Area (m²)	246.0
Top Area (m²)	37.5
Depth (m)	0.5
Invert Level (m AOD)	3.5
Estimated Storage Volume (m³) (1 in 100 year +25% CC)	12.1
Half Drain Times (minutes)	212

- 5.5.3 When discharging at a rate of 0.9l/s, the attenuation feature is shown to half-drain within 24 hours of the 3.3% AEP critical rainfall event and will therefore have capacity to continue to manage surface water runoff during likely subsequent rainfall events.
- 5.5.4 The attenuation volumes are provided for indicative purposes only and should be verified at the detailed design stage.

Everyday Rainfall

- 5.5.5 In line with the 2025 National Standards SuDS Defra guidance, in addition to managing extreme rainfall events, measures should be implemented to ensure runoff generate during more frequent everyday rainfall events is sustainably managed. For these events, at least the first 5mm of rainfall should not result in runoff from the site to watercourses or sewers and is managed within the development boundary.



- 5.5.6 Initial runoff volumes have been calculated by multiplying the initial 5mm rainfall depth by the respective catchment areas (Table 7). Based on the basin area, an additional storage depth of 0.24m at the base of the structures will provide sufficient attenuation to retain the first 5mm of rainfall on site which will then naturally dissipate over time via evapotranspiration.

Table 7: Everyday Rainfall Additional Attenuation Requirement

Contributing Area (m²)	246.0
Rainfall Depth (m)	0.005
Runoff Volume (m³)	1.2
Attenuation Basin Base Area (m²)	5
Additional Attenuation Depth (m)	0.24

5.6 Preferred Drainage Scheme

- 5.6.1 Based on the application of the drainage hierarchy, review of viable SuDS features, and hydraulic modelling, the preferred scheme is to attenuate surface water runoff in a linear basin located within the northeast area of the site prior to discharging to the unnamed land drain. The site will discharge at a controlled rate of 0.9l/s.
- 5.6.2 Surface water runoff up to the 1 in 100 year plus 25% climate change allowance event will be attenuated on site. A total attenuation volume of 12.1m³ will be required to achieve the proposed discharge rate.
- 5.6.3 The drainage layout drawing and hydraulic calculations (Appendices D and C, respectively) indicates there is sufficient space for these SuDS features to attenuate surface water runoff in up to the 1 in 100 year +25% climate change event.
- 5.6.4 Additional SuDS features could be included at the detailed design stage, such as lined permeable surfacing and filter drains. Inclusions of these features would further reduce the attenuation requirements of the linear basin.

5.7 Event Exceedance

- 5.7.1 Storage will be provided for the 1 in 100 year plus 25% CC event. Storm events in excess of the 1 in 100 year plus 25% CC event should be permitted to produce temporary shallow depth flooding within the drive-thru road and adjoining landscaped areas.
- 5.7.2 Based on topographic levels, any exceedance flooding will be directed to the northeast and discharge into the unnamed land drain before building to any significant depth.

5.8 Surface Water Treatment

- 5.8.1 In accordance with DEFRA's National standards for sustainable drainage systems and the Simple Index Approach as described in C753 The SuDS Manual (2015), low traffic roads have a 'low' pollution hazard level. Table 8 below shows the pollution hazard indices for each land use.

- 5.8.2 Where practical, runoff from drive-thru road will be directed to the linear basin and Table 9 demonstrates this SuDS feature provides sufficient treatment to water quality prior to it leaving the site.

Table 8: Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Individual Property Driveways, Residential Car Parks and Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

Table 9: SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' -Table 26.3

5.9 Maintenance

- 5.9.1 The new surface water drainage network is expected to be maintained privately and will be designed for operation and upkeep throughout the lifetime of the development, with suitable access and management systems in place.
- 5.9.2 As part of the maintenance regime, the system will be routinely inspected and cleared to minimise the risk of blockages. Maintenance of communal drainage features, such as a basin or swale, will be the responsibility of the site owner. Maintenance of shared surface water drainage systems can be arranged through appointment of a site management company.
- 5.9.3 Maintenance schedules for a basin and swale are included as Appendix E.
- 5.9.4 The proposed SuDS arrangement provides a minimum 5m buffer around the basin from the proposed building footprints and accessible for maintenance from all side. Access to the basin is provided via the adjoining green space.

5.10 Foul Water Discharge

- 5.10.1 Given that the proposed development is for the addition of a drive-thru lane, additional foul flows will not be produced, and a connection to the foul sewer is not required. The existing building will continue to drain to the foul network via its current arrangement with no changes to the existing foul drainage system.

6. Conclusions and Recommendations

6.1 Conclusions

- 6.1.1 The site is mainly located within Flood Zone 1, however Flood Zone 2 encroaches the northeastern corner associated with the unnamed land drain adjacent to the eastern boundary. The unnamed land drain ultimately joins the Black Ditch approximately 880m northeast of the site, which is a tidally influenced watercourse. Present-day flood zones appear to remain confined within the land drain, and the extent of Flood Zone 2 that encroaches onto the site remains below 4m AOD and is situated within the land drain channel.
- 6.1.2 Given that the Burger King restaurant is existing, the proposed development comprises only a small area of additional hardstanding to facilitate a drive-thru, the site is considered to be at Low risk of tidal/fluvial flooding. If more vulnerable development types are proposed in the future, it is recommended to attain receipt of EA Product Data which will likely provide climate change scenarios and flood depths for the site.
- 6.1.3 All other sources of flooding are considered Negligible to Low risk.
- 6.1.4 The preferred drainage scheme is to attenuate surface water runoff in a linear basin located within the northeast area of the site prior to discharging to the unnamed land drain. The site will discharge at a the lowest practicable controlled rate of 0.9l/s. Surface water runoff up to the 1 in 100 year plus 25% climate change allowance event will be attenuated on site. A total attenuation volume of 12.1m³ will be required to achieve the discharge rate.
- 6.1.5 Storage will be provided for the 1 in 100 year plus 25% CC event. Storm events in excess of the 1 in 100 year plus 25% CC event should be permitted to produce temporary shallow depth flooding within the car park / access road / landscaped areas.
- 6.1.6 It can be concluded that the inclusion of a detention basin will provide sufficient treatment to water quality prior to it leaving the site.
- 6.1.7 As part of the maintenance regime, the system will be routinely inspected and cleared to minimise the risk of blockages. Maintenance of communal drainage features such as a basin and/or oversized swale will be the responsibility of the site owner.
- 6.1.8 Given that the proposed development is for the addition of a drive-thru lane, a connection to the foul sewer is therefore not required.

6.2 Recommendations

Drainage Strategy

- Verify the attenuation volumes included in this report when undertaking detailed drainage design;
- Confirm the outfall location and the discharge rate with the LLFA; and

- Make provision for sustainable drainage features in the northeastern extent of the site.

Appendices

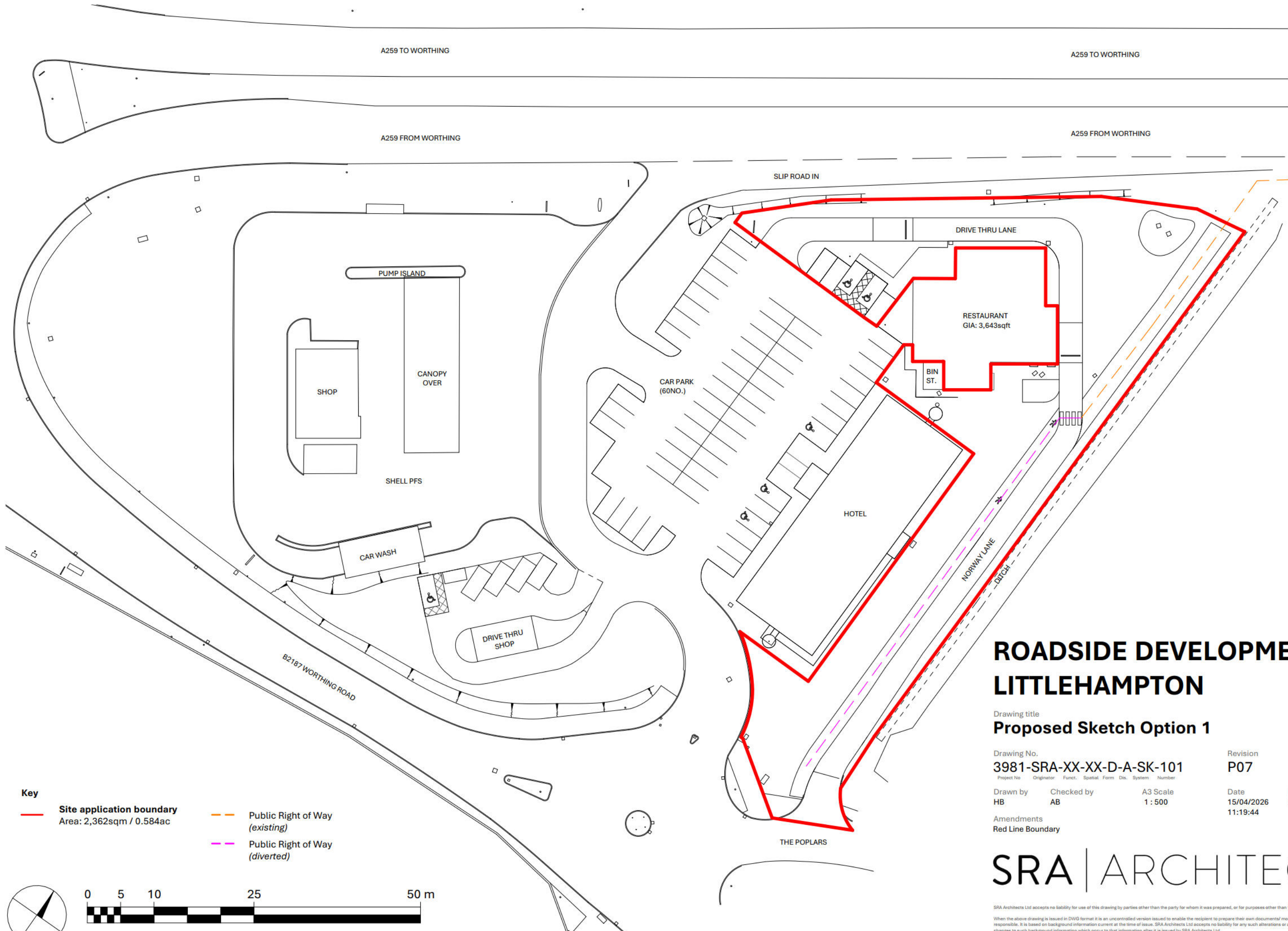
Appendix A- Limitations

Limitations

This report contains recommendations from Arthian, which are based on the information listed in the report and reflect the professional opinions of an experienced Environmental Consultant. Arthian obtained, reviewed, and evaluated information from the Client and others to prepare this report. The conclusions, opinions, and recommendations presented in this report are based on this information. However, Arthian does not guarantee the accuracy of the information provided and will not be held responsible for any opinions or conclusions reached based on information that is later proven to be inaccurate.

This report was prepared exclusively for the Client and for the specific purpose for which Arthian was instructed. It is not intended for use by anyone other than the Client without Arthian's written consent. Any unauthorized use of this report is at the sole risk of the user. Anyone using or relying on this report, other than the Client, agrees to indemnify and hold harmless Arthian from any claims, losses, or damages arising from the performance of the work by the Consultant.

Appendix B – Proposed Development



ROADSIDE DEVELOPMENT, LITTLEHAMPTON

Drawing title
Proposed Sketch Option 1

Drawing No.
3981-SRA-XX-XX-D-A-SK-101

Revision
P07

Drawn by
HB

Checked by
AB

A3 Scale
1 : 500

Date
15/04/2026
11:19:44

Reason for Issue
Sketch

Amendments
Red Line Boundary

SRA | ARCHITECTS

SRA Architects Ltd accepts no liability for use of this drawing by parties other than the party for whom it was prepared, or for purposes other than those for which it was prepared.

When the above drawing is issued in DWG format it is an uncontrolled version issued to enable the recipient to prepare their own documents/ models/drawings for which they are solely responsible. It is based on background information current at the time of issue. SRA Architects Ltd accepts no liability for any such alterations or additions to or discrepancies arising out of changes to such background information which occur to that information after it is issued by SRA Architects Ltd.

Responsibility is not accepted for errors made by others in scaling from this drawing. © (UK 2026) SRA Architects Ltd.

SRA Architects Ltd, Station House, Ashley Avenue, Bath, BA1 3DS | sra-architects.co.uk | Registered in England and Wales 14336944

Appendix C – Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Storage	0.026	5.00	4.000	0.000	0.000	0.500

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x
Analysis Speed	Normal	Additional Storage (m³/ha)	0.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	25	0	0

Node Storage Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	3.500	Product Number	CTL-SHE-0051-9000-0500-9000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.9	Min Node Diameter (mm)	1200

Node Storage Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	3.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	212

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	12.0	0.0	0.500	37.5	0.0



Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Storage	116	3.994	0.494	6.1	12.1499	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)				
120 minute winter	Storage	Hydro-Brake®	0.9	17.5				

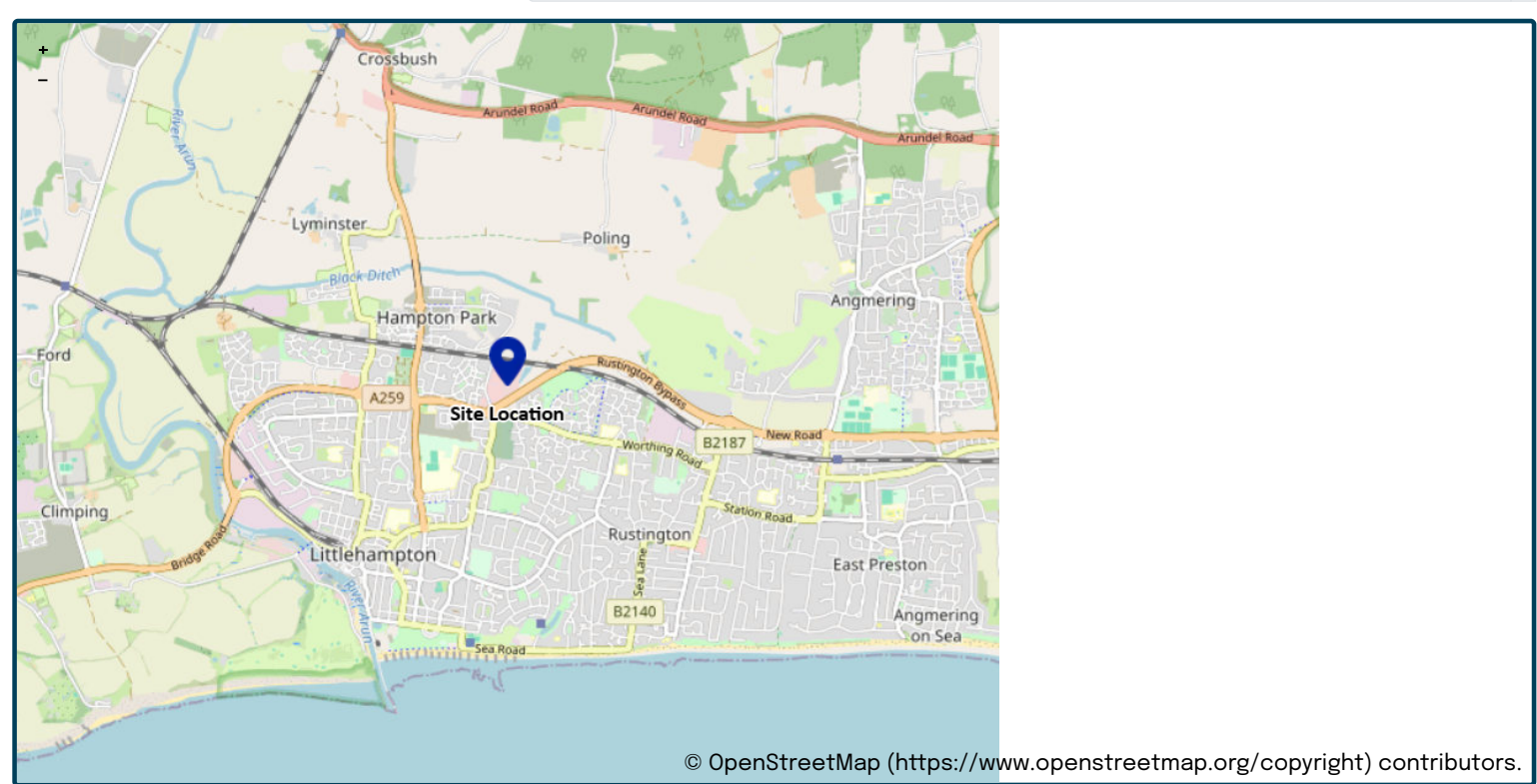
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	29/04/2026
Calculated by	GH
Reference	322080
Model version	2.2.3

Location

Site name	Burger King Worthington
Site location	



Site easting (British National Grid)	503876
Site northing (British National Grid)	103348

Site details

Total site area (ha)	0.0264	ha
----------------------	--------	----

Greenfield runoff

Method

Method	FEH statistical (2025)
--------	------------------------

FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	780	mm
BFIHOST19scaled	0.546	
QMed-QBar conversion	1.136	1.136
QMed (l/s)	0.1	l/s
QBar (FEH statistical 2025) (l/s)	0.1	l/s

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	7	7
1 year growth factor	0.85	
2 year growth factor	0.88	
10 year growth factor	1.62	
30 year growth factor	2.3	
100 year growth factor	3.19	
200 year growth factor	3.74	

Results

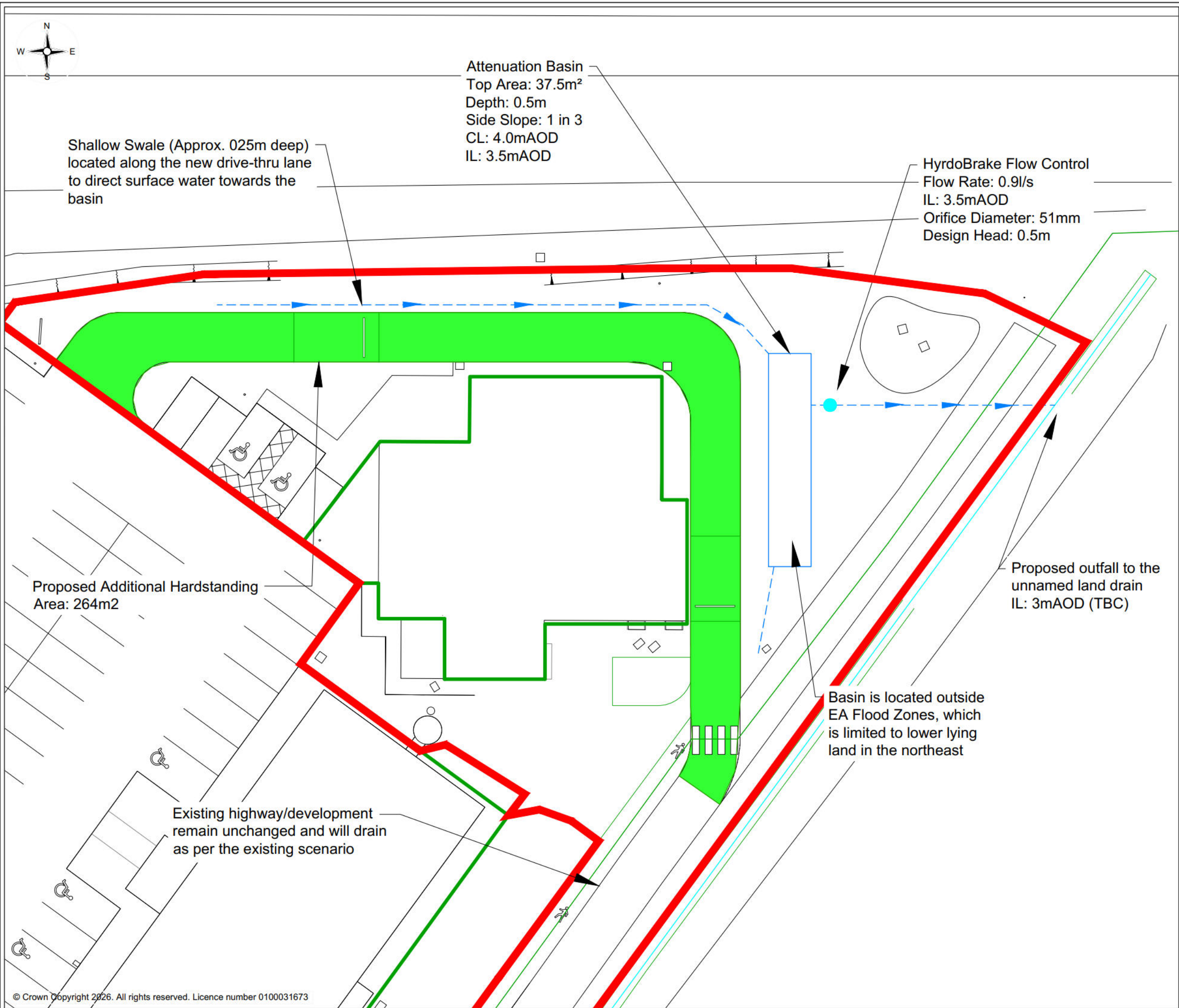
Method	FEH statistical (2025)
Flow rate 1 year (l/s)	0.1
Flow rate 2 year (l/s)	0.1
Flow rate 10 years (l/s)	0.1
Flow rate 30 years (l/s)	0.2
Flow rate 100 years (l/s)	0.3
Flow rate 200 years (l/s)	0.3

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Appendix D – Drainage Layout



- Legend:**
- Site Boundary
 - Proposed Surface Water Discharge Route
 - Existing Land Drain
 - Proposed Attenuation Basin
 - Proposed Hydrobrake (or similar flow control device)
 - Flow Direction
 - Proposed Additional Hardstanding

All Dimensions to be checked on site and not scaled from this drawing.
This drawing is conceptual and not for construction
This drawing is for planning only
All services to be checked on site and not scaled from this drawing



Arthian Ltd
13 Henderson Road,
Inverness,
IV1 1SN
info@arthian.com
+44 (0) 141 227 2300
https://www.arthian.com

Client:
Store Property Investments Ltd

Site:
Burger King, Worthington

Drawing Title:
Proposed Drainage Layout

Date: 18 May 2026	Scale: 1:400	Paper Size: A3 (297 x 420mm)
----------------------	-----------------	---------------------------------

Drawn By: GH	Checked By: JE	Status: Final	Final Revision: 1.0
-----------------	-------------------	------------------	------------------------

CAD Ref: 322080_Drainage_Layout_v1.0	Drawing No: / Client Ref: Figure 1
---	--

Appendix E – Maintenance Schedules

Swales Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut grass - to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or Reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 17.1

Detention Basins Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass - for spillways and access routes	Monthly (during growing season), or as required
	Cut grass - meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasion Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 22.1